


[Home](#) > [Journal](#) > [Earth & Environmental Sciences](#) > [AS](#)
[Indexing](#) | [View Papers](#) | [Aims & Scope](#) | [Editorial Board](#) | [Guideline](#) | [Article Processing Charges](#)
[AS](#) > Vol.3 No.3, May 2012



Sources of inaccuracy when estimating economically optimum N fertilizer rates

PDF (Size: 487KB) PP. 331-338 DOI: 10.4236/as.2012.33037

Author(s)

Martin Bachmaier

ABSTRACT

Nitrogen rate trials are often performed to determine the economically optimum N application rate. For this purpose, the yield is modeled as a function of the N application. The regression analysis provides an estimate of the modeled function and thus also an estimate of the economic optimum, N_{opt} . Obtaining the accuracy of such estimates by confidence intervals for N_{opt} is subject to the model assumptions. The dependence of these assumptions is a further source of inaccuracy. The N_{opt} estimate also strongly depends on the N level design, *i.e.*, the area on which the model is fitted. A small area around the supposed N_{opt} diminishes the dependence of the model assumptions, but prolongs the confidence interval. The investigations of the impact of the mentioned sources on the inaccuracy of the N_{opt} estimate rely on N rate trials on the experimental field Sieblerfeld (Bavaria). The models applied are the quadratic and the linear-plus-plateau yield regression model.

KEYWORDS

Confidence Interval; Economic Optimum; N Rate Trials; Quadratic Model; Linear-plus-Plateau Model

Cite this paper

Bachmaier, M. (2012) Sources of inaccuracy when estimating economically optimum N fertilizer rates. *Agricultural Sciences*, 3, 331-338. doi: 10.4236/as.2012.33037.

References

- [1] Lambert, D., Lowenberg-DeBoer, J. and Bongiovanni, R. (2002) Spatial Regression, an alternative statistical analysis for landscape scale on-farm trials: Case study of variable rate nitrogen application in Argentina. *Proceedings of the 6th International Conference on Precision Agriculture, ASA/CSSA/SSSA, Madison.*
- [2] Hernandez, J.A. and Mulla, D.J. (2008) Estimating Uncertainty of economically optimum fertilizer rates. *Agronomy Journal*, 100, 1221-1229. doi:10.2134/agronj2007.0273
- [3] Wagner, P. (1999) Produktionsfunktionen und Precision Farming (Response functions in the context of Precision Farming). *Zukunftsorientierte Betriebswirtschaft und Informationstechnologien in der Agrarwirtschaft. Gie?ener Schriften zur Agrarund Ern?hrungswirtschaft*, 29, 39-66.
- [4] Lark, R.M. and Wheeler, H.C. (2003) A method to investigate within-field variation of the response of combinable crops to an input. *Agronomy Journal*, 95, 1093-1104. doi:10.2134/agronj2003.1093
- [5] National Academy of Sciences, National Research Council (1961) *Statistical methods of research in economic and agronomic aspects of fertilizer response and use.* Committee on economics of fertilizer use of the agricultural board, NAS-NRC Pub. 918, NAS-NRC, Washington DC.
- [6] Cerrato, M.E. and Blackmer, A.M. (1990) Comparison of models for describing corn yield response to nitrogen fertilizer. *Agronomy Journal*, 82, 138-143. doi:10.2134/agronj1990.00021962008200010030x
- [7] Bullock, D.G. and Bullock, D.S. (1986) Quadratic and quadratic-plus-plateau models for predicting optimal nitrogen rate of corn: A comparison. *Agronomy Journal*, 86, 191-195.

[Open Special Issues](#)
[Published Special Issues](#)
[Special Issues Guideline](#)
[AS Subscription](#)
[Most popular papers in AS](#)
[About AS News](#)
[Frequently Asked Questions](#)
[Recommend to Peers](#)
[Recommend to Library](#)
[Contact Us](#)

Downloads:	138,534
Visits:	298,095

Sponsors, Associates, and Links >>

[2013 Spring International Conference on Agriculture and Food Engineering\(AFE-S\)](#)

- [8] Le Bail, M., Jeuffroy, M.-H., Bouchard, C. and Barbottin, A. (2005) Is it possible to forecast the grain quality and yield of different varieties of winter wheat from Minolta SPAD meter measurements? *European Journal of Agronomy*, 23, 379-391. doi:10.1016/j.eja.2005.02.003
- [9] Colwell, J.D. (1994) *Estimating fertilizer requirements: A quantitative approach*. CAB International, Wallingford.
- [10] Lehmann, E.L. (1986) *Testing statistical hypothesis*. John Wiley & Sons, Inc., New York.
- [11] Weisberg, S. (2005) *Applied linear regression*. John Wiley & Sons, Inc., New York. doi:10.1002/0471704091
- [12] Bachmaier, M. (2009) A confidence set for that x-Coordinate where the quadratic regression model has a given gradient. *Statistical Papers*, 50, 649-660. doi:10.1007/s00362-007-0104-1
- [13] Bachmaier, M. (2011) Fortran programs: 1. Confidence set for the economically optimum nitrogen fertilization in the quadratic model: VINO.EXE. 2. Confidence set for that x-coordinate where the quadratic regression model has a given gradient (incl. special case: confidence set for the x-coordinate of the parabola's vertex): CIGIGRAD. EXE and CIVERTX.EXE. <http://www.tec.wzw.tum.de/index.php?id=46&L=1>
- [14] Fieller, E.C. (1954) Some problems in interval estimation. *Journal of the Royal Statistical Society*, B16, 175-185.
- [15] Koziol, D. and Zielinski, W. (2003) Comparison of confidence intervals for maximum of a quadratic regression function. *Biometrical Letters*, 40, 57-64.
- [16] Mittelhammer, R.C., Judge, G.G. and Miller, D.J. (2000) *Econometric foundations*. Cambridge University Press, Cambridge, 183-185.
- [17] Casella, G. and Berger, R.L. (2002) *Statistical inference*. Duxbury Press, Belmont.
- [18] Cook, R.D. and Weisberg, S. (1990) Confidence curves in nonlinear regression. *Journal of the American Statistical Association*, 85, 544-551. doi:10.2307/2289796
- [19] Boyd, D.A., Yuen, L.T.K. and Needham, P. (1976) Nitrogen requirement of cereals. *Journal of Agricultural Science*, 87, 149-162. doi:10.1017/S0021859600026708
- [20] Waugh, D.L., Cate, R.B. and Nelson, L.A. (1973) Discontinuous models for rapid correlations, interpretation und utilization of soil analysis and fertilizer response data. *International Soil Fertility Evaluation and Improvement Program*, North Carolina State University, Raleigh.
- [21] Motulsky, H.J. and Christopoulos, A. (2003) PRISM, Version 4.0. Fitting models to biological data using linear and nonlinear regression. A practical guide to curve fitting, GraphPad Software Inc., San Diego.
- [22] Liebler, J. (2003) *Feldspektroskopische messungen zur ermittlung des stickstoffstatus von winterweizen und mais auf heterogenen schlaggen*. Herbert Utz Verlag, Munich.
- [23] Hurley, T.M., Malzer, G.L. and Kilian, B. (2004) Estimating site-specific nitrogen crop response functions: A conceptual framework and geostatistical model. *Agronomy Journal*, 96, 1331-1343. doi:10.2134/agronj2004.1331
- [24] Hurley, T.M., Oishi, K. and Malzer, G.L. (2005) Estimating the potential value of variable rate nitrogen applications: A comparison of spatial econometric and geostatistical models. *Journal of Agricultural and Resource Economics*, 30, 231-249.
- [25] Anselin, L., Bongiovanni, R. and Lowenberg-DeBoer, J. (2004) A spatial economic approach to the economics of site-specific nitrogen management in corn production. *American Journal of Agricultural Economics*, 86, 675- 687. doi:10.1111/j.0002-9092.2004.00610.x
- [26] Bullock, D.S., Lowenberg-DeBoer, J. and Swinton, S.M. (2002) Adding value to spatially managed inputs by understanding site-specific yield response. *Agricultural Economics*, 27, 233-245. doi:10.1111/j.1574-0862.2002.tb00119.x
- [27] Bachmaier, M. and Gandorfer, M. (2009) A conceptual framework for judging the precision agriculture hypothesis with regard to site-specific nitrogen fertilization. *Precision Agriculture*, 10, 95-110. doi:10.1007/s11119-008-9069-x
- [28] Abraham, T.P. and Rao, V.Y. (1965) An investigation on functional models for fertilizer response

studies. *Journal of the Indian Society of Agricultural Statistics*, 18, 45-61.

- [29] Anderson, R.L. and Nelson, L.A. (1975) A family of models involving intersecting straight lines and concomitant experimental designs useful in evaluating response to fertilizer nutrients. *Biometrics*, 31, 303-318. doi: 10.2307/2529422
- [30] Barreto, H.J. and Westermann, R.L. (1987) YELDFIT: A computer program for determining economic fertilization rates. *Journal of Agronomical Education*, 16, 11-14.
- [31] Nelson, L.A., Voss, R.D. and Pesek, J.T. (1985) Agronomic and statistical evaluation of fertilizer response. In: Engelstad, O.P., Ed., *Fertilizer Technology and Use*, ASA, Madison, 53-90.